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SYSTEMATIC REVIEW

Artificial Intelligence in Education: a Systematic Literature Review

Inteligencia Artificial en Educación: una Revisión Sistemática de la Literatura

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ABSTRACT

The article explores the increasing influence of artificial intelligence (AI) in education, addressing contemporary challenges and highlighting its significance in refining teaching methods and enhancing learning efficiency. It is a structured literature review that systematically analyzes existing literature on AI in education, drawing insights from prominent researchers to understand current and future trends. Four key questions guide the analysis: the relationship between education and AI, their interaction, AI's contribution to educational evolution, and research challenges. The study employs a systematic review of literature, focusing on works by eminent scholars such as Lee, Memarian, and Yuan, selected from the Scopus database spanning from 1986 to 2024. It follows a structured approach to gather and analyze data from selected studies. The article progresses by presenting an introduction to the topic, outlining the methodology, and summarizing and analyzing key findings from selected literature. It explores the intrinsic relationship between education and AI, their interaction, and AI's role in evolving the educational process. Major findings underscore the importance of a cautious and ethical approach to integrating AI in education. Despite its potential benefits, challenges and shortcomings in current research are acknowledged, urging for further exploration and consideration of ethical implications.

Keywords: Artificial Intelligence; Education; Computer Science; Technology; Digital Platforms.

RESUMEN

El artículo explora la creciente influencia de la inteligencia artificial (IA) en la educación, abordando desafíos contemporáneos y resaltando su importancia en el refinamiento de los métodos de enseñanza y el mejoramiento de la eficiencia del aprendizaje. Es una revisión de literatura estructurada que analiza sistemáticamente la literatura existente sobre IA en educación, extrayendo ideas de destacados investigadores para comprender las tendencias actuales y futuras. Cuatro preguntas clave guían el análisis: la relación entre educación e IA, su interacción, la contribución de la IA a la evolución educativa y los desafíos de investigación. El estudio emplea una revisión sistemática de la literatura, enfocándose en trabajos de destacados académicos como Lee, Memarian y Yuan, seleccionados de la base de datos Scopus desde 1986 hasta 2024. Sigue un enfoque estructurado para recopilar y analizar datos de estudios seleccionados. El artículo avanza presentando una introducción al tema, delineando la metodología y resumiendo y analizando hallazgos clave de la literatura seleccionada. Explora la relación intrínseca entre educación e IA, su interacción y el papel de la IA en la evolución del proceso educativo. Los principales hallazgos destacan la importancia de un enfoque cauteloso y ético para integrar la IA en la educación. A pesar de sus posibles beneficios, se reconocen desafíos y limitaciones en la investigación actual, instando a una mayor exploración y consideración de las implicaciones

éticas.

Palabras clave: Inteligencia Artificial; Educación; Informática; Tecnología; Plataformas Digitales.

INTRODUCTION

The rapid advancement of artificial intelligence (AI) technology has revolutionized various sectors, including education, offering promising solutions to address the myriad challenges faced by modern educational systems. With AI's capabilities to refine teaching methodologies, improve learning outcomes, and provide personalized education experiences, its integration into education has become imperative. Through a systematic review of select literature, we aim to delve into the multifaceted applications of AI in education, exploring methodologies, outcomes, and ethical considerations. By analyzing the works of esteemed researchers[1,2,3], our study aims to provide a comprehensive understanding of current trends and future possibilities in AI's role within educational contexts.

Our analysis not only seeks to highlight recent advancements and achievements but also acknowledges the ethical and practical challenges inherent in the integration of AI into education. By shedding light on both opportunities and obstacles, we aim to offer insights that inform future research directions and foster a more nuanced understanding of the implications of AI adoption in educational settings. Ultimately, our study underscores the importance of approaching AI integration in education with careful consideration of ethical principles and a commitment to maximizing its potential benefits while mitigating risks.

This article aims to delve into the impact of AI on education, drawing on recent developments and research in this area.

In this context, the relationship between education and artificial intelligence (AI) emerges as a fascinating field, prompting a thorough analysis through literature review. Consequently, this article examines the current state of studies regarding education and AI, exploring the following research questions:

- Q1: What is the relationship between education and AI?
- Q2: How do education and AI interact?
- Q3: How does AI enhance the educational process?
- Q4: What are the current gaps in research frameworks and approaches used to study the relationship between AI and education?

We have structured this article as follows. We first introduced the topic of our literature review. Next, we presented the methodology used to address our research questions. Subsequently, we summarized and analyzed the selected studies. Finally, we presented the main conclusions of our study, focusing on related research avenues.

METHODS

A systematic literature review was employed to provide a critical overview of the current research topic. [5] It distinguishes itself from narrative analysis through its methodical approach, which includes a detailed description of the steps taken to select and analyze the literature, aiming to minimize biases and enhance transparency.[5] This work is based on a systematic review of 20 articles identified in the Scopus database.

In this study, we conducted a literature review to examine the intersection between education and artificial intelligence (AI). To do so, we primarily relied on the Scopus database to gather relevant data on this topic. Subsequently, using specific inclusion criteria, we filtered our results to retain only the most pertinent articles for our inquiry. The detailed methodology of our literature review is presented in figure 1.

As a first step, we carried out an initial search in the Scopus database, focusing on titles and abstracts that incorporated the terms "education" and "artificial intelligence". This initial search resulted in the selection of 30 articles. As previously mentioned, we first undertook a preliminary search in the Scopus database, concentrating on titles and abstracts containing the terms "Artificial Intelligence" and "Education". The subsequent search yielded 30 articles: TITLE-ABS-KEY (artificial-intelligence AND education). Next, we narrowed down our search scope by focusing on articles and conference papers in the fields of computer science and engineering, resulting in 20 articles. We formulated the corresponding search query as follows:

TITLE-ABS-KEY (artificial-intelligence AND education) AND (LIMIT TO (SUBJAREA, "COMP") OR LIMIT TO (SUBJAREA, "ENGI")) AND (LIMIT-TO (DOCTYPE, "cp") OR LIMIT-TO (DOCTYPE, "ar")).

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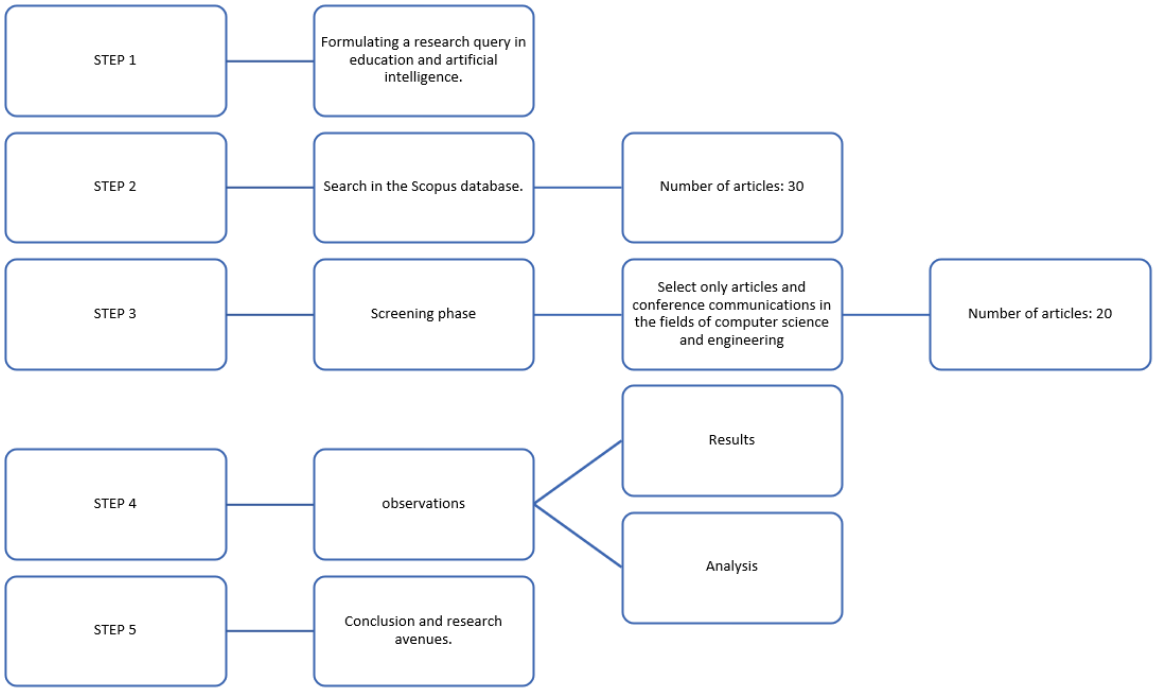

Figure 1. Methodology for the literature review on AI and education

Figure 2 illustrates the evolution of research on "education" and "AI" from 1986 to 2024 in the fields of engineering and computer science. From 1986 to 2015, there was a noticeable lack of literature on the relationship between AI and education. However, starting in 2016, we observed a steady increase in interest in the topic within the academic community, particularly in 2016, 2019, 2021, 2022, and 2024. Thus, despite some fluctuations, we believe the topic is becoming increasingly important in academia, justifying the need for our research.

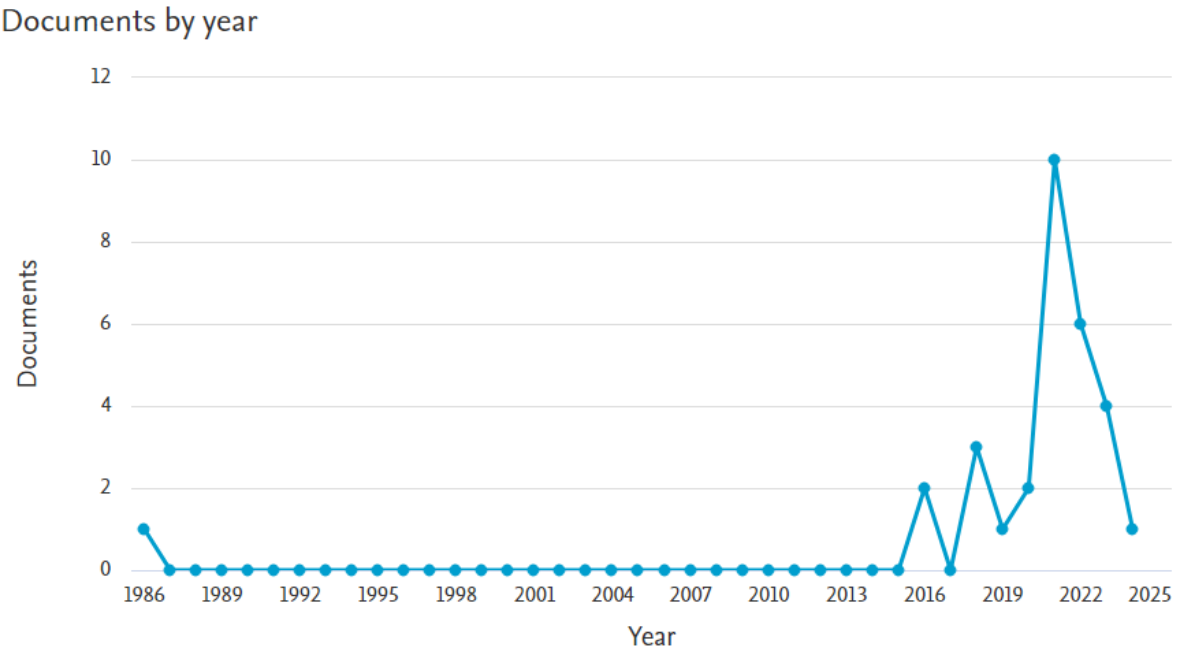

Figure 2. Timeline evolution of research on artificial intelligence and education

During the second phase of selection, we applied the inclusion criteria outlined in Table 1 to identify the most relevant articles on the intersection of education and AI. Additionally, we included studies that address a specific type of innovation, namely open innovation. We also incorporated research that integrates crowdsourcing, due to its emergence as a new and non-traditional form of collaboration. Consequently, we identified 20 articles that met the inclusion criteria after manually removing duplicates to avoid redundancy.

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Finally, to conclude this phase, we established additional criteria to ensure the quality of the previously selected research.

Table 1. Inclusion and Quality Assessment Criteria

Inclusion Criteria	The study delves into the theoretical foundations of education. The investigation discusses the theoretical underpinnings of Artificial Intelligence (AI). The study focuses on a specific type of educational approach. The research explores crowdsourcing as an enhanced form of AI. The examination highlights the role of AI in educational settings. The study outlines frameworks, architectures, or case studies incorporating AI. Haut du formulaire
Quality Assessment Criteria	The paper sets forth a clear research objective. The document introduces a novel framework for an existing AI system. The paper presents a well-defined architecture, framework, or design. The research contrasts a new framework with an established one. The study delves into the roles, significance, and behavior of individuals. The paper offers solutions to educational challenges using AI.

We conducted quality assessment through independent evaluation by the authors, using the aforementioned criteria. For each article, we assessed and assigned a score to the criteria based on the responses provided by the authors. We selected articles that scored 3 or above for data synthesis, as indicated in the table below.

Table 2. Comparison of Selected Articles

Reference	QC1	QC2	QC3	QC4	QC5	QC6	TOTAL
(1)	yes	yes	yes	yes	no	yes	5
(2)	yes	yes	no	yes	yes	no	4
(3)	no	no	yes	no	yes	yes	3
(4)	no	no	yes	yes	no	yes	3
(5)	no	no	no	yes	yes	yes	3
(6)	yes	yes	yes	yes	no	yes	5
(7)	yes	yes	yes	Yes	yes	no	5
(8)	yes	yes	yes	yes	yes	yes	6
(9)	no	no	no	yes	yes	yes	3
(10)	no	no	no	yes	yes	yes	3
(11)	yes	yes	yes	no	no	yes	4
(12)	yes	yes	yes	yes	yes	yes	6
(13)	yes	yes	yes	yes	yes	yes	6
(14)	no	no	no	yes	yes	yes	3
(15)	no	no	yes	no	yes	yes	3
(16)	no	yes	yes	yes	no	yes	4
(17)	yes	yes	yes	yes	yes	yes	6
(18)	yes	yes	yes	yes	no	yes	5
(19)	yes	yes	yes	yes	no	yes	5
(20)	no	yes	yes	yes	no	yes	4

Summary of Selected Studies

Below, we summarize the 20 selected studies:

The integration of artificial intelligence (AI) into various fields, such as education, management, and medicine, is at the forefront of current discussions on technological innovation.[1] introduce an innovative initiative of integrating computational intelligence (CI) into young students' education through a particle swarm optimization-based agent, though the focus leans more towards methodology than concrete outcomes. Conversely,[2] explores the incorporation of indigenous knowledge modes into AI-enhanced education, suggesting a multidisciplinary approach while highlighting the lack of specificity in proposed solutions.[3] delves into intelligent management accounting, showcasing a practical case study but lacking depth in analyzing impacts and challenges.[4] offers a cartographic analysis of sports AI research over 25 years, revealing a comprehensive perspective but calling for deeper discussion on practical implications. [7] examines the efficiency of AI in assisted translation tools, while[8,9] discusses the impact of AI and blockchain in higher education, both highlighting opportunities while overlooking certain ethical and practical challenges. Finally,[10] focuses on emotional intelligence to predict occupational stress, while[11] introduces an innovation in hands-on electronics teaching through AI, showcasing

the range of AI applications across various domains with their potential benefits and limitations.

This article presents a historical and prospective view, exploring the evolution of ancient Chinese education and aiming to harmonize traditional methods with modern technologies. However, [12] it could benefit from a more in-depth analysis of challenges specific to this integration. [13] It also emphasizes the impact of AI on foreign language teaching, identifying four key areas of innovation and highlighting the importance of collaboration among diverse education stakeholders. Therefore,[14] it explores the application of AI in diagnosing and treating Autism Spectrum Disorder (ASD), offering promising perspectives for enhancing patient care but requiring broader contextualization of practical and ethical implications. Lastly,[15] it focuses on using AI to predict landslides in Taiwan, illustrating the importance of AI in enhancing public safety through meteorological and geotechnical data analysis. These studies reflect the diversity of AI applications and highlight the opportunities, challenges, and ethical implications associated with its increasing integration across various societal sectors.

The summaries address the growing impact and integration of artificial intelligence (AI) across various fields, including education, educational management, and policy.[16] underscores the significance of AI in ideological and political education, highlighting its capabilities in temporal and spatial expansion, personalized education, and human-machine integration for effective educational resource management.

focusing on the evolution of education through AI,[17] suggesting that the deep integration of these two domains will be the dominant trend in the future.[18] examines the reform of university physical education information services, emphasizing the opportunities provided by AI for data collection, decision-making, and assessment, while acknowledging challenges such as privacy and data security. [19] introduce a hybrid method using Recurrent Neural Networks (RNN) to enhance E-Learning systems, showing promising accuracy in predicting student outcomes. [20] discusses the positive prospects of AI in educational management while highlighting ethical and security challenges associated with its integration, calling for proper regulation and education to maximize its benefits and minimize risks.

Table 3. Summary of the Analysis

Authors	Context	Objectives	Methodology	Results
[1]	The article falls within the field of artificial intelligence and machine learning	Propose a computational intelligence (CI) agent based on particle swarm optimization (PSO) for the learning of young students	Using a CI agent combining human-inspired fuzzy systems languages with machine languages based on PSO. Experiments conducted during CI Sandbox workshops and competitions.	Young students were able to learn and experiment with CI using the CI&AI-FML learning tool with a CI agent based on PSO. Three experiments were conducted, demonstrating the ability to collect and infer real-time data
[2]	Integration of pedagogy and artificial intelligence	Exploring the integration of indigenous knowledge modes into technologically enriched pedagogy by AI.	Review of AI programs and discussion of technological, educational, and philosophical challenges.	Identifying challenges of integrating indigenous knowledge modes into engineering education and proposing an equitable and inclusive approach.
[3]	Management accounting and modern technology.	Building and analyzing an intelligent management accounting platform.	Integration of business intelligence, AI, and management accounting	The platform has enhanced automation, visualization, intelligence, and decision-making efficiency in management for Guangdong JL Company
[4]	Research in sports artificial intelligence.	Analyzing research and trends in sports artificial intelligence	Analysis of 549 literature using CiteSpace V.	The United States, China, and Germany are leaders in the field. Machine learning is central, with a notable interest in activity recognition and analysis based on wearable sensors.
[5]	Computer-Assisted Translation (CAT) and artificial intelligence	Analyzing the application of the AI-powered non-translatables feature in computer-assisted translation	Analysis of the AI-powered non-translatables feature in CAT	Identifying the benefits of the AI-powered non-translatables feature to enhance translation efficiency and reduce costs
[6]	Impact of artificial intelligence and blockchain on education.	Examine the opportunities and challenges of the era of artificial intelligence and blockchain for professional education.	Discussion on the influence of AI and blockchain on professional education	AI and blockchain present opportunities and challenges for professional education, requiring reform and innovation.

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(7)	Use of AI in various fields, including education.	Analyzing the development and challenges of AI education in primary and secondary schools	Description and analysis of the development of AI education	Presenting current challenges in integrating AI into education and recommendations for future research.
(8)	Use of AI in teaching English at the university level	Analyzing the integration of AI in teaching English at the university level and proposing a new model.	Analysis of the current state of English teaching and proposal of a new model based on AI.	Proposal of a university English teaching model integrating AI to enhance efficiency and relevance
(9)	Childhood asthma treatment and the use of AI	Evaluate the effectiveness of the PDCA nursing care model in treating childhood asthma with AI	Using the genetic simulated annealing (GSA) algorithm to optimize the backpropagation neural network.	Proposal of an Improved Genetic Simulated Annealing Backpropagation Network (IGSA-BP) to enhance the effectiveness of childhood asthma treatment
(10)	Emotional intelligence influences individual success in various areas of life	Using an artificial neural network to predict occupational stress.	892 participants from various professional categories were selected. 15 dimensions from the Bar-On questionnaire, 10 professional categories, age, and education were considered as input variables, while 7 dimensions from the Health and Safety Executive (HSE) were used as output variables.	The artificial neural network with 375 hidden neurons outperformed multivariate regression in terms of performance. The correlation between the predicted values and occupational stress was higher in the neural network model (correlation between 0,527 and 0,364) compared to the multivariate regression model (correlation between 0,192 and 0,364)
(11)	Evolution of practical electronics teaching in a context of increasing student numbers.	Installation of a remote laboratory system for electronics practical work	Development of a remote E@ Slab laboratory system and use of artificial intelligence algorithms to evaluate and rank students	The artificial intelligence algorithm correctly classified students with an accuracy of over 90%, thereby validating its effectiveness in identifying students' gaps and weaknesses.
(12)	Influence of artificial intelligence on education and traditional educational methods	Examine the historical development of education in ancient China to guide the future development of education in the era of artificial intelligence.	Study of the educational system and the imperial examination system in ancient China	Identification of current challenges in combining traditional education with modern methods based on artificial intelligence
(13)	Impact of artificial intelligence on foreign language teaching.	Identify and describe innovations in foreign language teaching in the era of artificial intelligence.	Analysis of innovations in educational organization, teaching methods, teacher skills, and selection of educational resources	Artificial intelligence enables highly personalized learning and better collaboration between teachers and machines
(14)	Increasing incidence of Autism Spectrum Disorder (ASD) and challenges in early diagnosis and treatment.	Evaluate the potential of artificial intelligence for the diagnosis and treatment of ASD	Literature review on the application of artificial intelligence in the diagnosis and intervention of ASD.	Artificial intelligence offers opportunities for efficient and accurate clinical diagnosis of ASD as well as for improving interventions.
(15)	Frequency of landslides in Taiwan caused by rainfall	Using artificial intelligence to predict rainfall and prevent landslides.	Using recurrent neural network (RNN) and long short-term memory (LSTM) models to predict precipitation trends	RNN and LSTM models effectively predict precipitation and anticipate landslide risks
(16)	Evolution of artificial intelligence and its impact on societal transformations.	Explore the opportunities and challenges of artificial intelligence in the ideological and political domain.	Analysis of the opportunities provided by artificial intelligence for ideological and political education in educational institutions.	Artificial intelligence enables the expansion of ideological and political education methods, offers personalized education, and facilitates the co-construction and management of educational resources

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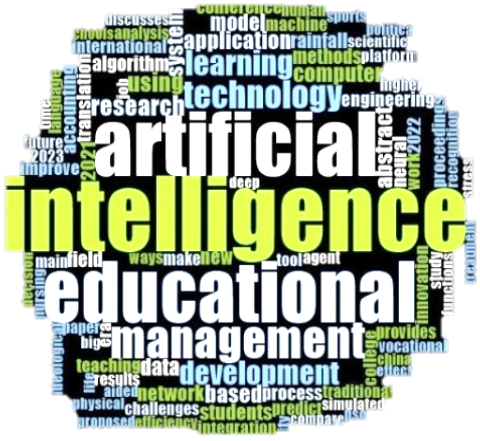
(17)	Growing interest in the integration of artificial intelligence in education.	Examine the current state of research and development trends of artificial intelligence in the educational field	Study of applications, research, and integration of artificial intelligence in education.	The deep integration of artificial intelligence and education is a growing trend, requiring talent training in artificial intelligence and an evolution of educational methods.
(18)	Need to modernize information services in university physical education	Analyze the reform of information services in university physical education based on artificial intelligence.	In-depth study of the relationship between big data, computerization, and artificial intelligence in physical education	Artificial intelligence offers opportunities for changes in data collection, management decision-making, governance models, and evaluation in physical education.
(19)	Growing importance of the E-Learning system in modern education	Propose a hybrid method combining artificial intelligence to enhance E-Learning in the computer science department of the University of Technology in Iraq	Using the Artificial Neural Networks (ANNs) algorithm and optimizing with the ADAM optimizer to predict student outcomes	The hybrid model demonstrated promising accuracy compared to other machine learning methods, thus providing an effective tool for predicting student outcomes
(20)	Rapid development of artificial intelligence and its implications for society	Explore the progressive integration of artificial intelligence and educational management	Analysis of the advantages and disadvantages of integrating artificial intelligence into educational management	Integrating artificial intelligence into educational management offers benefits such as increased efficiency but also poses challenges like privacy violations and ethical concerns

These authors provide an overview of the various application areas and recent advancements in the field of artificial intelligence, management, education, healthcare, and computer-assisted translation. Each author offers a unique perspective on the integration and use of artificial intelligence in their respective fields, highlighting opportunities, challenges, and innovations in these areas.

ANALYSIS

In the initial stage of the analysis, we used the Nvivo software to provide a visual overview of the predominant themes in the selected articles. We first generated the word cloud (see figure 3) to offer a visual representation of the word frequency across the 20 articles.



Source: Nvivo 10 software.
Figure 3. Word cloud of the selected papers

We found that the word cloud revolves around the theme of artificial intelligence and depicts a multifaceted landscape. Furthermore, the word cloud highlights notable terms associated with intelligence, including “clearing,” “intelligent,” “thinking,” “words.” For instance, the term “education” implies the role of “artificial” “intelligence” in the development of the educational system. In addition to these major components, the word

cloud reveals several subtle yet significant features. Terms like "technology," "management," and "data" suggest that some articles emphasize the managerial and collaborative aspects of artificial intelligence, both in the public sector and in community-driven contexts. Moreover, the terms "technology," "information," and "software" all point to the importance of information technology and software in the context of education and artificial intelligence. In summary, the selected articles collectively explore the theoretical foundations, practical applications, and strategic significance of artificial intelligence, focusing on their role across various research contexts and particularly in crisis contexts where they have garnered interest in the educational sector.

To better understand the thematic landscape, we utilized the word frequency graph to quantitatively analyze the prevalence of key terms across the selected articles to validate the insights gained from the word cloud (see figure 3). This analysis identifies "innovation" as the most prevalent word, with a higher number of occurrences. This is followed by "artificial intelligence," "education," "management," "technology," and "learning." This finding highlights the interdependent aspects that lead to synergy between education and artificial intelligence.

Figure 4. The word frequency chart

Word	Length	Number	Weighted Percentage (%)	Cumulative (%)
Intelligence	12	173	5,46	5,79
Artificial	9	194	5,33	
Education	10	142	4,53	4,53
Management	10	84	2,46	2,46
Technology	10	61	1,72	1,72
Learning	8	73	1,68	1,68

Source: Nvivo 10 software.

The results validate the relevance of our research methodology, as we found that the majority of the articles address our central themes of "artificial intelligence" and "education". However, some articles go beyond by incorporating "technology", "management", and "learning".

Critical analysis of the relationship between education and AI:

Q1: What is the relationship between education and AI?

The relationship between education and AI is closely tied to technological innovation. AI is integrated into education for various applications, ranging from enhancing teaching methods to efficient educational resource management and personalized learning. [12] and [16] emphasize that AI has the potential to expand education temporally and spatially, offer personalized education, and facilitate human-machine integration for better educational management.

Q2: How do education and AI interact?

Education and AI interact through various initiatives and research. AI is used to improve teaching methods, personalize learning, collect data for assessment, and even integrate indigenous knowledge. AI is also used to predict student outcomes and support foreign language teaching. Studies highlight collaboration among different education stakeholders to optimize the benefits of AI.

[12]: They emphasize the importance of innovation in foreign language teaching in the AI era, highlighting organizational innovation, teacher skills, and the use of pedagogical resources.

[13]: Focuses on integrating AI into university English teaching, proposing a new AI-based teaching model.

[17]: Discuss the impact of AI on higher vocational education, emphasizing that AI can transform the traditional vocational teaching model and promote leaps in development through technologies like blockchain.

[4]: Examines the use of AI in sports education, highlighting progress and research directions in this field.

[20]: Highlights the importance of AI in educational management while cautioning against challenges related to privacy, ethics, and security.

Q3: How does AI enhance the educational process?

AI enhances the educational process by offering innovative tools and personalized teaching methods. It facilitates data collection to assess and adapt teaching methods, and it supports predicting student outcomes. AI also enables more inclusive education by integrating indigenous knowledge and adapting teaching to different learning styles. It is also used to enhance the efficiency of E-Learning systems.

[12]: Highlight the use of AI to propose countermeasures to improve university English teaching, combining AI advantages to offer educators a reference.

[13]: Proposes a new AI-based university English teaching model, emphasizing how AI enhances teaching this

subject.

[17]: Emphasize that AI can transform the traditional higher vocational teaching model, promoting leaps in development through technologies like blockchain, thereby enhancing the educational process.

[4]: Examines how AI is used to improve sports education, highlighting progress and research directions in this field, contributing to enhancing the educational process.

[20]: Cautions against challenges related to integrating AI into educational management while highlighting the potential benefits of this integration for modernizing and intellectualizing educational management.

Q4: What are the current research gaps in the frameworks and approaches used to study the relationship between AI and education?

While the provided studies offer a diverse insight into AI applications in education, some gaps remain. Several studies, like [1] and [3], focus more on methodology than on tangible results, limiting our understanding of AI's actual effectiveness in education. Moreover, despite the emphasis on AI benefits, there is a lack of in-depth analysis of the ethical, security, and privacy challenges associated with its integration. Some articles could also benefit from broader contextualization and deeper exploration of the practical implications of AI in education.

In conclusion, while AI offers promising opportunities to revolutionize education, it is essential to continue conducting rigorous and balanced research to maximize its benefits while mitigating its potential limitations and challenges.

CONCLUSION

In this article, we conducted a literature review to assess the existing body of work on the potential of artificial intelligence (AI) in advancing education. To achieve this, we analyzed data gathered from the Scopus database spanning from 1983 to March 2024. To refine our results, we limited our search to articles in the fields of pedagogy, education, and educational technology, along with specific inclusion, exclusion, and quality assessment criteria. This meticulous selection process led to the identification of 20 articles that met the objective of our study. To analyze these articles, we employed a dual approach, using a visual overview of predominant themes via Nvivo software and a critical content analysis for a deeper examination of each study's key findings.

According to our findings, the articles cover the significance of AI in education across both public and private sectors from various perspectives. Some authors discuss the integration of AI as a means to facilitate adaptive and personalized learning among students. Other authors have emphasized the role of AI in different types of education, including online education, blended learning, and project-based learning. Notably, the role of AI technology in bridging learning gaps by integrating differentiated teaching methods and learning assistance tools was highlighted. Furthermore, some articles asserted that open education and AI go hand in hand to nurture learners' curiosity and enhance the learning process. While others discussed the potential of AI tools in improving open education and the overall education process. Controversially, one article delved into the role of open education in creating fertile ground for peer collaboration and AI utilization.

Additionally, we observed that several authors use "adaptive learning" as a synonym for AI in education. They emphasized its importance in overcoming organizational limitations and succeeding in the educational process. Some authors view AI as a common type of adaptive learning, highlighting its role in facilitating learning, decision-making, and problem-solving. While others refer to adaptive learning as a form of open education that reinforces an institution's educational capabilities. Moreover, several articles advocated for the mediating role of information technology in bolstering AI for education by integrating digital tools (e.g., adaptive learning software, online learning platforms, E-learning, educational chatbots, etc.). However, we noticed that most reviewed articles do not focus sufficiently and solely on AI and education but integrate other concepts such as online learning, pedagogy, evaluation, etc. This results in a lack of modeling and new frameworks that solely address the targeted issue. This calls for future studies to conduct empirical and more focused research focusing on education and AI and modeling the link between the two based on their key components.

Furthermore, following quality assessment, we noticed that most articles do not compare their work with existing frameworks. This indicates that the author's primary aim is to focus on their unique viewpoints. Additionally, the main limitations of our study lie in our research methodology. The first limitation is in our database choice as we solely relied on Scopus due to time constraints. However, future research should conduct a longitudinal study that integrates other existing databases, namely Web of Science, IEEE Explore, PLOS-One, ACM digital library, etc. The second limitation lies in our keyword choice as our analysis through Nvivo software showed the interdependence of our topic with other terms, namely adaptive learning and open education. The third and final limitation lies in our exhaustive inclusion and quality assessment criteria as they could have restricted our search and limited our results.

In conclusion, although the presented studies offer a diverse insight into AI applications in education, it is imperative to adopt a more critical, collaborative, and forward-looking approach to fully harness the

potential of AI in this field. Continuous evaluation, interdisciplinary collaboration, and appropriate regulation are essential to effectively navigate this rapidly evolving technological landscape.

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CONFLICT OF INTEREST

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